

Computerized Waters

Model changes management of Texas surface waters



In an office on the second floor of a Texas A&M University building, on a desktop computer operating with the popular Microsoft Windows, Dr. Ralph Wurbs has designed a computer modeling system that has changed the way Texas manages its rivers, streams and reservoirs.

The modeling system called Water Rights Availability Package, or WRAP for short, is a set of computer programs developed by Wurbs, a professor of civil engineering, and his graduate students that simulates management of the water resources of river basins. The model helps determine how much and at what level of reliability water will be available for environmental and human needs.

The Texas Commission on Environmental Quality (TCEQ) uses WRAP in its Texas Water Availability Modeling (WAM) system to evaluate and approve surface water right permits in Texas. Any water resources development project or water use action involving the streams and lakes of the state requires either a new permit or modification of an existing permit. The WRAP/WAM modeling system determines whether sufficient water is available for a proposed new or expanded water use and assesses the impacts on all the other water uses in the river basin.



Dr. Ralph Wurbs, professor of civil engineering, examines the Texas river basin maps with Richard Hoffpauir, graduate student. These maps were developed, using the WAM/WRAP modeling system. Hoffpauir traveled to Armenia to help that country work on water modeling and availability.



Dr. Ralph Wurbs of the Department of Civil Engineering has published five technical reports on the WRAP modeling system with the Texas Water Resources Institute.

Currently, the state has about 8,000 active water right permits.

TCEQ requires that permit applicants and their consultants use the WRAP/WAM system in preparing their applications.

“Discussion of pertinent issues is significantly enhanced by both the water right permit applicant and regulatory agency staff using the same modeling system,” Wurbs said.

TCEQ and its partner agencies—Texas Water Development Board and Texas Parks and Wildlife Department—and consulting firms developed the WAM system after the Texas Legislature enacted Senate Bill 1 in 1997, following the drought of 1996.

In addition to the generalized WRAP simulation model, the WAM system has specific information (or datasets) for all 23 river basins in the state.

Ten consulting engineering firms, under contract with TCEQ during 1997–2003, developed the individual datasets and simulated a set of alternative water-use scenarios. The Center for Research in Water Resources at the University of Texas provided geographic information system (GIS) support for developing the datasets. During the same time Wurbs and his graduate students, working under a contract

between the commission and the Texas Water Resources Institute, expanded WRAP methodologies and software from earlier versions.

The state currently has active permits for about 3,500 reservoirs, thousands of water supply diversions, several hydroelectric plants and numerous environmental instream flow requirements. Each of these active permits is included in the datasets.

Besides the commission using the WAM/WRAP modeling system in water rights permitting, the Texas Water Development Board and its 16 regional planning groups use the modeling system for developing its water plans, which were also mandated by Senate bill 1. TCEQ’s approval of water right permit applications requires that proposed actions be consistent with relevant regional plans.

River authorities, water districts and other water management organizations are beginning to use the WRAP model in operational planning studies to optimize operations of their facilities and available water resources, Wurbs said.

“The Texas experience has also generated interest in similar applications of WRAP in other states and countries,” he said, including a project in Armenia by one of his graduate students. 

